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Honouring the participatory mapping contributions and enduring legacy of Professor Gregory G. Brown

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A B S T R A C T

This commentary honours the seminal and foundational contributions of Professor Gregory G. (Greg) Brown to the fields of public participation geographic information systems (PPGIS), natural resource management and spatial planning. We synthesise his work into four theses that underpinned his three decades of research: 1) The mapping of place values provides place-specific information about sense of place which can aid in the assessment of the risks associated with landscape modification; 2) PPGIS analysis techniques can support socially acceptable and scientifically defensible land-use decisions in multiple planning contexts; 3) Issues of representation and data quality can be systematically investigated and managed; and 4) While PPGIS is increasingly being applied by cities and other organisations globally, there remains multiple challenges regarding the use of PPGIS findings in land-use decision making. We then briefly summarise his future visions for PPGIS research into: improving participation, and identifying and controlling threats to spatial data quality; turning PPGIS from a participation tool to a political force that can engage with the politics of place and, related to the previous vision; building capacity and champions for those who see the value in participatory mapping methods and are willing to articulate publicly how participatory contributions will be used. The co-authors and all signatories to this commentary are deeply grateful for the many ways that Greg has touched our lives over the years. He will be sadly missed.

1. Introduction

Professor Gregory G. (Greg) Brown's contributions to public participation geographic information systems (PPGIS), natural resource management and spatial planning have been foundational. Over three decades, he and his network led the rapid growth of participatory mapping studies globally (four publications per year in 1997 to over 30 per year in 2019, Scopus). He wrote multiple seminal works relating to the mapping of place values (the values assigned by individuals to places, including residents and visitors) to guide natural resource management and regional and urban land-use planning. He published over 120 journal articles, including 19 articles in *Applied Geography,* that have formed the basis of contemporary research and practice on how to systematically identify, map and compare place values with other landscape inventories (SciVal: h-index 38; 114 citing countries over career 1996–2020; 55% of papers in top 10% citation percentiles).

Important premises about democracy underpinned Greg's research. First, drawing upon his interdisciplinary background in computer science, human geography and natural resource management, he strongly believed in the "wisdom of crowds" and recognised that local knowledge is a legitimate and important source of knowledge for land-use decisions. The quality of land-use decisions can be improved by engaging crowd and public judgement through PPGIS (Brown, 2015). Further, he sought to move spatial planning from a consultative process where loud voices dominate land-use decision making processes to a more empowered process acknowledging that decisions should be made by those most affected by them (Brown, 2005). Greg worked diligently to spread these ideals globally. He founded the Landscape Values and PPGIS Institute and helped establish the International Society for Participatory Mapping (ISPM) to facilitate global research and communication about participatory spatial planning methods.

This commentary aims to recognise Greg's main scholarly contributions, including his core arguments and visions for future research. We hope that it will be of inspiration to those seeking to carry forward important questions concerning how to further develop and upscale PPGIS concepts and methods into spatial planning globally.

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2. Four main theses of Greg's research on participatory mapping

Thesis 1: The mapping of place values provides place-specific information about sense of place which can aid in the assessment of the risks associated with landscape modification

Conceptually, Greg firmly believed that an "operational bridge is needed to connect special place locations (geography of place) with their underlying perceptual rationale (psychology of place) for ecological planning and resource management purposes" (Brown, 2005, p. 19). Early work on the development and validation of landscape values typology (Brown & Reed, 2000 building on; Rolston & Coufal, 1991), which evolved into a place values typology (Brown, Reed & Raymond, 2020), created such a bridge. In his most-cited work, Brown and Raymond (2007) demonstrated that place values are an adequate proxy of place attachment, providing place-specific information about the characteristics of the environment, as well as constructed meanings and place attachment. Later research confirmed that spatial indicators of place values are related to, but not identical to place attachment (Brown et al., 2015). These views depart from early research on sense of place, which largely focused on place as a social construction, ignoring the potential contributions of the physical environment to sense of place (see arguments by Stedman, 2003). In their paper on 10 lessons for the mapping of place values using PPGIS, Brown et al. (2020) suggest that spatial indicators of sense of place can "provide a useful indicator of whether local opposition (or support) is likely to materialize in the event of a proposed significant change in land use (i.e., "NIMBY" ("not in my backyard") or "YIMBY" ("yes in my backyard") responses).

Thesis 2: PPGIS analysis techniques can support socially acceptable and scientifically defensible land-use decisions in multiple planning contexts

Greg and his colleagues created a plethora of novel analytical techniques to demonstrate that the mapping of place values and development preferences, among other spatial attributes, could support socially acceptable and scientifically defensible land-use decisions. In forest and protected area management applications, he and his colleagues developed value compatibility analysis tools for informing which forest management or conservation options were most consistent with place values and where conflict was most likely to occur (Brown & Donovan, 2013; Brown & Reed, 2009, 2011, 2012; Brown & Weber, 2011; Raymond & Brown, 2006); and identifying the most appropriate places for mining, commercial forestry, recreation, hunting and/or nature protection (Brown et al., 2017; Hausner et al., 2014; Muñoz et al., 2019). In regional planning he and his colleagues showed how PPGIS techniques could be used in conjunction with classifications of landscape character to improve the effectiveness of landscape evaluation (Brown & Brabyn, 2012b; 2012a).

Greg and his colleagues also developed an array of conflict analysis tools. They demonstrated how residents' development preferences could be used to protect scenic and ecologically important areas from development (Raymond & Brown, 2007), or to manage conflicts between supportive and opposing preferences for tourism or residential and industrial development (Brown & Raymond, 2014; Moore et al., 2017; Strickland-Munro et al., 2016). In urban planning, he led teams that analysed the consistency, compatibility, and potential conflict of general land-use plans and zoning with place values (Brown, Sanders, et al., 2018).

Greg and his colleagues also advanced socio-ecological hotspot mapping and conservation value metrics to inform conservation priorities in protected areas and forested land (Alessa et al., 2008; Brown, 2013), and the management of remote coastal zones (Kobryn et al., 2018) and urban parks (Brown et al., 2014, 2018). His research, and that of his wider network, provided the impetus for the 'cultural turn' in the ecosystem management literature, i.e., the shift from biophysical and monetary assessments of ecosystem services (as per the Millennium Ecosystem Assessment) to the non-monetary assessment of social and cultural values for ecosystem services (e.g., Brown & Fagerholm, 2014; Fagerholm et al., 2016; Raymond et al., 2009; Sherrouse et al., 2011; van Riper et al., 2017). Collectively these tools could reveal hotspots and coldspots that are socially acceptable to residents and visitors for conservation and development, and also the synergies and trade-offs between areas identified by scientists, planners and residents to be ecologically important.

Thesis 3: Issues of representation and data quality can be systematically investigated and managed

While Greg promoted the benefits of participatory mapping for land-use decision-making, he was willing to critically examine and systematically assess issues of representatitiveness and data quality, and more specifically, issues of sampling, participation, and spatial accuracy and precision. He conducted critical reviews and empirical examinations to assess the quality of PPGIS data collated using different sampling techniques (Brown, 2017; Brown et al., 2015a,b; Brown et al., 2014), and the likely impact of low participation rates on PPGIS outputs (Brown 2012). He also critically examined issues of spatial accuracy, including: whether the method of value collation affected the spatial distribution of responses (Brown, Donovan, et al., 2014); how the mapping technique (point vs. polygon) and the sampling design influenced the spatial intensity and distribution of values and preferences (Brown 2012; Brown et al., 2014; Brown et al., 2014); and how different spatial metrics of values and potential for development conflict might inform land-use planning (Brown & Raymond, 2014; Brown & Reed, 2012, 2011; Karimi & Brown, 2017; Lechner et al., 2015). Drawing on empirical evidence from multiple case areas across the world, he argued that it is possible to both systematically investigate and manage different forms of sampling and participation biases, and issues of data quality and spatial precision.

Thesis 4: While PPGIS is increasingly being applied by cities and other organisations globally, there remains multiple challenges regarding the use of PPGIS findings in land-use decision making

PPGIS has been successfully applied in planning cases globally at various scales and different phases of the planning project (e.g., Jankowski et al., 2019; Kahila-Tani et al., 2019). The application of PPGIS by cities continues to grow globally, which can in part be attributed to the research and innovation of Greg and his colleagues. However, various challenges remain concerning the use of PPGIS findings in land-use decision-making. In 2012, Greg summarised the main barriers to use of PPGIS data being: 1) fear of the general public; 2) lack of experience in non-legalistic participatory planning techniques; 3) the expert-lay divide in that experts do not trust local knowledge or do not view it as valid; and 4) regulatory barriers to public participation (Brown & Reed, 2011, 2012). An analysis of 200 recent planning cases suggests that PPGIS uptake is impeded by the different motivations of urban planners, the challenges of reaching a broad spectrum of people and the realisation that planning is informed by different types of knowledge, and can be elicited through different forms of engagement processes (Kahila-Tani et al., 2019).

3. Greg's future directions

We encourage readers to turn to one of Greg's last papers entitled "Mapping place values: 10 lessons from two decades of public participation GIS empirical research" (Brown et al., 2020) for important guidance on the main lessons learnt from PPGIS research. Here we focus on important future directions Greg noted in this and other papers.

3.1. Improving participation, and identifying and controlling threats to spatial data quality

Greg encouraged further work into improving the level of participation in PPGIS studies. Further research is needed to customize the methods and associated electronic tools to the needs of diverse groups, including vulnerable groups, and for retaining public engagement during the participation process. He also encouraged a shift from advancement in PPGIS technology to a renewed emphasis on the engagement process including examining the possibilities for PPGIS to support collaboration, negotiation and consensus-building rather than simple collection of spatial data (Brown & Kyttä, 2014). Concurrently, he urged new enquiries into controlling threats to spatial data quality, including sampling and participation bias, the quality associated with mapping effort, and sampling and participation coverage.

3.2. Turning PPGIS from a participation tool to a political force that can engage with the politics of place

Greg encouraged a much stronger focus on the collation of evidence to inform the use of PPGIS data in land-use decisions. "To be influential in the future, the mapping of place values will need to be become more than a spatial technology enhancement to public participation, but a political force that can compete against powerful interests that currently dominate land use decision processes at multiple levels of government" (Brown et al., 2020). Such a transition will require new ways of collating evidence of how PPGIS data informs land-use decisions, as well as holistically considering how issues of power and interest constrain or promote the use of PPGIS data in land-use decision-making. This will necessitate transdisciplinary enquiry involving planners, political scientists and PPGIS professionals, among others, in addition to those with expertise in legal and regulatory barriers to the use of scientific evidence in planning applications.

3.3. Building capacity and champions for those who see the value in participatory mapping methods and are willing to publicly articulate how participatory contributions will be used

Building capacity is core to addressing the knowledge to practice gap. Greg invested much of his time in the International Society for Participatory Mapping (ISPM) with this goal in mind. ISPM is an association of scholars and practitioners, and committed to the equitable distribution of PPGIS knowledge across the globe (see http://landscapevalues.org/ispm/membership-get-involved/). In partnership with ISPM and other PPGIS networks globally, we as co-authors look forward to building the capacity of PPGIS research (e.g., through training events, research seminars and research centres) in support of Greg's legacy.

4. Recognising Greg's wider contributions to society

Greg was a terrific leader, mentor and teacher. At California Polytechnic State University, Greg was Chair and Department Head of Natural Resource Management and Environmental Sciences (2016–2020). At the University of Queensland (2010–2016), Greg was Head of the Planning Program and also Chair of the Teaching and Learning Committee. He was a very generous colleague who provided effective and fair leadership, and was always ready to support his peers and students. Greg was also deeply respected by friends and his colleagues from his previous academic appointments at Central Washington University, Green Mountain College, University of South Australia, Alaska Pacific University and Southern Illinois University, as well as his former PhD students who drew on PPGIS applications from across the world including Australia, China, Finland, Norway and Africa. Throughout his career, Greg often gave freely of his time, expertise, and funds to promote and test practical, decision-supporting participatory GIS work in several United States federal land management agencies and leaves a number of grateful and admiring associates within those agencies. He also generously gave his time to spatial planning agencies in Canada, Australasia and the Nordic region.

Greg will also be sadly missed by his family. He was a wonderful and generous father and partner. Our hearts go out to his partner Mare and children who have been of terrific support to Greg over the years. He will be greatly missed.

We as co-authors and signatories to this commentary are sincerely grateful to Greg for the many inspiring conversations and fun moments shared together. We all admired his modesty, humour and intelligence, and his willingness to help us out at a moment's notice. We hope that Greg's theses and visions for future research will continue inspire the hearts and minds of scholars well into the future.

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References

Alessa, L., Naia), Kliskey, A., Anaru), & Brown, G. (2008). Social-ecological hotspots mapping: A spatial approach for identifying coupled social-ecological space. *Landscape and Urban Planning, 85*(1), 27–39. https://doi.org/10.1016/j.landurbplan.2007.09.007.

Brown, G. (2005). Mapping spatial attributes in survey research for natural resource management: Methods and applications. *Society & Natural Resources, 18*(1), 17–39. https://doi.org/10.1080/08941920590881853.

Brown, G. (2012). Public Participation GIS (PPGIS) for regional and environmental planning: Reflections on a decade of empirical research. *URISA Journal, 24*(2), 7–18.

Brown, G. (2013). The relationship between social values for ecosystem services and global land cover: An empirical analysis. *Ecosystem Services, 5*, 58–68. https://doi.org/10.1016/j.ecoser.2013.06.004.

Brown, G. (2015). Engaging the wisdom of crowds and public judgement for land use planning using public participation geographic information systems. *Australian Planner, 52*(3), 199–209. https://doi.org/10.1080/07293682.2015.1034147.

Brown, G. (2017). A review of sampling effects and response bias in internet participatory mapping (PPGIS/PGIS/VGI). *Transactions in GIS, 21*(1), 39–56. https://doi.org/10.1111/tgis.12207.

Brown, G., & Brabyn, L. (2012a). An analysis of the relationships between multiple values and physical landscapes at a regional scale using public participation GIS and landscape character classification. *Landscape and Urban Planning, 107*(3), 317–331. https://doi.org/10.1016/j.landurbplan.2012.06.007.

Brown, G., & Brabyn, L. (2012b). The extrapolation of social landscape values to a national level in New Zealand using landscape character classification. *Applied Geography, 35*(1–2), 84–94. https://doi.org/10.1016/j.apgeog.2012.06.002.

Brown, G., & Donovan, S. (2013). Escaping the national forest planning quagmire: Using public participation GIS (PPGIS) to assess acceptable national forest use. *Journal of Forestry, 111*(2), 115–125.

Brown, G., Donovan, S., Pullar, D., Pocewicz, A., Toohey, R., & Ballesteros-Lopez, R. (2014a). An empirical evaluation of workshop versus survey PPGIS methods. *Applied Geography, 48*, 42–51. https://doi.org/10.1016/j.apgeog.2014.01.008, 0.

Brown, G., & Fagerholm, N. (2014). *Empirical PPGIS/PGIS mapping of ecosystem services: A review and evaluation*. Ecosystem Services. https://doi.org/10.1016/j.ecoser.2014.10.007.

Brown, G., Kangas, K., Juutinen, A., & Tolvanen, A. (2017). Identifying environmental and natural resource management conflict potential using participatory mapping. *Society & Natural Resources, 30*(12), 1458–1475. https://doi.org/10.1080/08941920.2017.1347977.

Brown, G., Kelly, M., & Whitall, D. (2014b). Which 'public'? Sampling effects in public participation GIS (PPGIS) and volunteered geographic information (VGI) systems for public lands management. *Journal of Environmental Planning and Management, 57*(2), 190–214. https://doi.org/10.1080/09640568.2012.741045.

Brown, G., & Kyttä, M. (2014). Key issues and research priorities for public participation GIS (PPGIS): A synthesis based on empirical research. *Applied Geography, 46*, 122–136.

Brown, G., & Raymond, C. (2007). The relationship between place attachment and landscape values: Toward mapping place attachment. *Applied Geography, 27*(2), 89–111. https://doi.org/10.1016/j.apgeog.2006.11.002.

Brown, G., & Raymond, C. M. (2014). Methods for identifying land use conflict potential using participatory mapping. *Landscape and Urban Planning, 122*, 196–208. https://doi.org/10.1016/j.landurbplan.2013.11.007, 0.

Brown, G., Raymond, C. M., & Corcoran, J. (2015a). Mapping and measuring place attachment. *Applied Geography, 57*, 42–53. https://doi.org/10.1016/j.apgeog.2014.12.011.

Brown, G., & Reed, P. (2000). Validation of a forest values typology for use in national forest planning. *Forest Science, 46*(2), 240–247.

Brown, G., & Reed, P. (2009). Public participation GIS: A new method for use in national forest planning. *Forest Science, 55*(2), 166–182.

Brown, G., & Reed, P. (2011). Social landscape metrics: Measures for understanding place values from public participation geographic information systems (PPGIS). *Landscape Research, 37*(1), 73–90. https://doi.org/10.1080/01426397.2011.591487.

Brown, G., & Reed, P. (2012). Values Compatibility Analysis: Integrating public values in a forest planning decision support system. *Applied Spatial Analysis and Policy, 5*(4), 317–332.

Brown, G., Reed, P., & Raymond, C. M. (2020). *Mapping place values: 10 lessons from two decades of public participation GIS empirical research*. Applied Geography. https://doi.org/10.1016/j.apgeog.2020.102156.

Brown, G., Rhodes, J., & Dade, M. (2018a). An evaluation of participatory mapping methods to assess urban park benefits. *Landscape and Urban Planning, 178*, 18–31. https://doi.org/10.1016/j.landurbplan.2018.05.018.

Brown, G., Sanders, S., & Reed, P. (2018b). Using public participatory mapping to inform general land use planning and zoning. *Landscape and Urban Planning, 177*, 64–74. https://doi.org/10.1016/j.landurbplan.2018.04.011.

Brown, G., Schebella, M. F., & Weber, D. (2014c). Using participatory GIS to measure physical activity and urban park benefits. *Landscape and Urban Planning, 121*, 34–44. https://doi.org/10.1016/j.landurbplan.2013.09.006.

Brown, G., & Weber, D. (2011). Public participation GIS: A new method for national park planning. *Landscape and Urban Planning, 102*(1), 1–15. https://doi.org/10.1016/j.landurbplan.2011.03.003.

Brown, G., Weber, D., & de Bie, K. (2015b). Is PPGIS good enough? An empirical evaluation of the quality of PPGIS crowd-sourced spatial data for conservation planning. *Land Use Policy, 43*, 228–238. https://doi.org/10.1016/j.landusepol.2014.11.014.

Fagerholm, N., Oteros-Rozas, E., Raymond, C. M., Torralba, M., Moreno, G., & Plieninger, T. (2016). Assessing linkages between ecosystem services, land-use and well-being in an agroforestry landscape using public participation GIS. *Applied Geography, 74*, 30–46. https://doi.org/10.1016/j.apgeog.2016.06.007.

Hausner, V. H., Brown, G., & Lægreid, E. (2014). Effects of land tenure and protected areas on ecosystem services and land use preferences in Norway. *Land Use Policy, 49*, 446–461. https://doi.org/10.1016/j.landusepol.2015.08.018.

Jankowski, P., et al. (2019). Geoweb methods for public participation in urban planning: Selected cases from Poland. In K. Koutsopoulos, R. de Miguel González, & K. Donert (Eds.), *Geospatial challenges in the 21st century. Key challenges in geography (EUROGEO book series)*. Cham: Springer.

Kahila-Tani, M., Kytta, M., & Geertman, S. (2019). Does mapping improve public participation? Exploring the pros and cons of using public participation GIS in urban planning practices. *Landscape and Urban Planning, 186*, 45–55. https://doi.org/10.1016/j.landurbplan.2019.02.019.

Karimi, A., & Brown, G. (2017). Assessing multiple approaches for modelling land-use conflict potential from participatory mapping data. *Land Use Policy, 67*, 253–267. https://doi.org/10.1016/j.landusepol.2017.06.004.

Kobryn, H. T., Brown, G., Munro, J., & Moore, S. A. (2018). Cultural ecosystem values of the Kimberley coastline: An empirical analysis with implications for coastal and marine policy. *Ocean & Coastal Management, 162*, 71–84. https://doi.org/10.1016/j.ocecoaman.2017.09.002.

Lechner, A. M., Brown, G., & Raymond, C. M. (2015). Modeling the impact of future development and public conservation orientation on landscape connectivity for conservation planning. *Landscape Ecology, 30*(4). https://doi.org/10.1007/s10980-015-0153-0.

Moore, S. A., Brown, G., Kobryn, H., & Strickland-Munro, J. (2017). Identifying conflict potential in a coastal and marine environment using participatory mapping. *Journal of Environmental Management, 197*, 706–718. https://doi.org/10.1016/j.jenvman.2016.12.026.

Muñoz, L., Hausner, V., Brown, G., Runge, C., & Fauchald, P. (2019). Identifying spatial overlap in the values of locals, domestic- and international tourists to protected areas. *Tourism Management, 71*, 259–271. https://doi.org/10.1016/j.tourman.2018.07.015.

Raymond, C. M., & Brown, G. (2006). A method for assessing protected area allocations using a typology of landscape values. *Journal of Environmental Planning and Management, 49*(6), 797–812. https://doi.org/10.1080/09640560600945331.

Raymond, C., & Brown, G. (2007). A spatial method for assessing resident and visitor attitudes towards tourism growth and development. *Journal of Sustainable Tourism, 15*(5), 520–540. https://doi.org/10.2167/jost681.0.

Raymond, C. M., Bryan, B. A., MacDonald, D. H., Cast, A., Strathearn, S., Grandgirard, A., et al. (2009). Mapping community values for natural capital and ecosystem services. *Ecological Economics, 68*(5), 1301–1315. https://doi.org/10.1016/J.ECOLECON.2008.12.006.

Rolston, H., & Coufal, J. (1991). A forest ethic and multivalue forest management. *Journal of Forestry, 89*(4), 35–40.

Sherrouse, B. C., Clement, J. M., & Semmens, D. J. (2011). A GIS application for assessing, mapping, and quantifying the social values of ecosystem services. *Applied Geography, 31*(2), 748–760. https://doi.org/10.1016/j.apgeog.2010.08.002.

Stedman, R. C. (2003). Is it really just a social construction? The contribution of the physical environment to sense of place. *Society & Natural Resources, 16*(8), 671–685. https://doi.org/10.1080/08941920309189.

Strickland-Munro, J., Kobryn, H., Brown, G., & Moore, S. A. (2016). Marine spatial planning for the future: Using Public Participation GIS (PPGIS) to inform the human dimension for large marine parks. *Marine Policy, 73*, 15–26. https://doi.org/10.1016/j.marpol.2016.07.011.

van Riper, C. J., Kyle, G. T., Sherrouse, B. C., Bagstad, K. J., & Sutton, S. G. (2017). Toward an integrated understanding of perceived biodiversity values and environmental conditions in a national park. *Ecological Indicators, 72*, 278–287. https://doi.org/10.1016/j.ecolind.2016.07.029.